Liver

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Anatomy of Liver

- Largest organ
- Right upper quadrant
- Having large right lobe and smaller left lobe
Anatomy of Liver

- **Functional anatomy: “Couinaud”**
  - Divided into 2 lobes along the line passing between gall bladder fossa and middle hepatic vein. “Cantil’s line”
Anatomy of Liver

- 8 segments
  - I – IV -------functional left lobe
  - V – VIII ------Functional right lobe
Anatomy of Liver

Ligaments that fix the liver in its place:

- Left triangular ligament
- Right triangular ligament
- Falciform ligament
- Lesser omentum (hepatoduodenal ligament)
Anatomy of Liver

Hilum of liver:
- Bile duct
- Hepatic artery
- Portal vein
Anatomy of Liver

Foramen of Winslow:

- Anterior: CBD, HA, PV
- Posterior: IVC
- Upper: Liver
- Lower: duodenum
Anatomy of Liver

Liver Blood supply:

- Portal vein 80%
- Hepatic artery 20%
Internal anatomy of liver:

**Liver Lobule:**
- Is the functional unit within liver segments
Embryology

- Foregut:
  - hepatocytes
  - Biliary passages
- Septum transversum
  - Kupffer cells
Liver Functions

- Synthesis and storage of amino acids, proteins, vitamins and fats
- Blood glucose regulation
- Detoxification
- Blood circulation and filtration
Liver Functions

- Metabolism of bilirubin
- Formation of bile;
- Water, electrolytes, bile pigments, bile salts, phospholipids (lecithin), and cholesterol.
Metabolism of bilirubin
Investigations of liver

Liver Function tests:

- USED TO
  - Detect presence of liver disease
  - Distinguish among different types of liver diseases
  - Gauge the extent of known liver damage
  - Follow the response of treatment
Tests for excretory function

- Serum bilirubin
- Urine bilirubin
- Blood ammonia
Tests that indicate liver cell injury

- Serum enzymes:
  - AST
  - ALT
  - Gamma-glutamyl transpeptidase
Serum Enzymes – that reflect cholestasis

- Serum Alkaline phosphatase
- 5’Nucleotidase
Tests that measure Biosynthetic function of liver

- Serum Albumin
- PT, INR
Imaging of liver

- **Ultrasound:**
  - First line test
  - Useful for
    - Liver SOL
    - State of biliary passages
    - As a guide for needle liver biopsy or catheterization.
Doppler Ultrasound:
- Blood flow
- Vascularity of liver tumors
Computerized tomography (CT scan)

- Triple-phase spiral CT is the gold standard imaging modality of liver.
  - Liver lesions down to 1 cm
  - Its density can be measured
  - Vascularity of lesion---contrast
Magnetic resonance imaging

- More or less similar to CT scan
- Its advantages:
  - No radiation
  - No contrast of value in allergy to iodine
Magnetic resonance cholangiopancreatography (MRCP):
- Provide excellent quality imaging of biliary tracts non-invasively.

Magnetic resonance angiography (MRA):
- Provide high quality images of portal veins and hepatic arteries without the need for cannulation.
Endoscopic retrograde cholangiopancreatography (ERCP)

- Diagnosis
- Therapeutic
- Indications:
  - Obstructive jaundice?
  - Imaging suggested abnormality in biliary tracts
ERCP

- Preparation:
  - Checking coagulation state; PT, INR
  - Informed consent:
    - Pancreatitis
    - Cholangitis
    - Bleeding
    - Perforation of duodenum
  - Prophylactic antibiotics
Therapeutic ERCP

- Sphincterotomy and Stone retrieval from CBD
- Balloon dilatation of strictures
- Stenting (Endoprosthesis) of strictures of CBD.
Percutaneous transhepatic cholangiography

- Indications:
  - When Endoscopic cholangiography failed
  - When ERCP impossible  polyga gastrectomy
Selective Visceral angiography

- Diagnosis
  - Clear anatomy of hepatic artery prior to liver resections

- Therapy:
  - Embolization
    - arteriovenous malformation
    - Stop bleeding from liver
    - Chemoembolization for liver tumors
Nuclear medicine scanning

- Technetium 99m labeled radionuclide:
  - Handled like bile and so its uptake and excretion can be monitored in real time.
  - Useful in:
    - Bile leak
    - Bile obstruction
Laparoscopy and laparoscopic ultrasound

- Staging of liver tumors
- Detection of small lesions not detected by other imaging modalities
  - Peritoneal seedlings
  - Small superficial lesions
- Help in detection of other additional lesions not detected by CT or MRI
Fluorodeoxyglucose-potron emission tomography

- Helpful for determining the nature of a mass lesion detected by other imaging modalities
Liver trauma

- Blunt injuries:
  - Contusion, laceration, avulsion
- Penetrating injuries:
  - Stab
  - Gunshot
Diagnosis of liver injury:

- Clinical suspicion of liver injury
  - All lower chest and upper abdominal stab wounds should be suspect, especially if considerable blood volume replacement has been required.
  - Similarly, severe crushing injuries to the lower chest or upper abdomen often combine rib fractures, haemothorax and damage to the spleen and/or liver
- Tools may be of help in the diagnosis of liver injury:
  - FAST
  - Peritoneal aspirate
  - Laparoscopy
Management of liver injury

- General consideration:
  - Not usual
  - Serious
  - Think of associated injuries
Management of liver injury

**General plan:**
- General resuscitation: ATLS
  - **Penetrating injury**: emergency laparotomy
  - **Blunt injury**: stable circulation after initial resuscitation sent the patient for:
    - CT scan with oral and iv contrast
Management of liver injury

- **Blunt injury to liver**
  - There is a place for conservative treatment

- **When to stop conservative treatment**
  - Ongoing blood loss
  - Generalized peritonitis
Surgical approach to liver trauma

- Good and wide access (rooftop) incision
- Stop blood inflow “Pringle manoeuvre”
- Suturing of tears
- Excision of avulsed devitalized tissue
- Repair of major vessel injury
- Packing
Complications

- Massive blood loss
- Abscess ..... Subcapsular hematoma
- Bile collection “Biloma:; Biliary fistula
- Arteriovenous fistula
- Arteriobiliary fistula
- Hepatic artery aneurysm
- Liver failure
Pyogenic liver abscess

- **Aetiology:** in the majority unknown
- **Possible causes:**
  - Impaired biliary drainage
  - Hematogenous drug abuse, teeth cleaning
  - Local spread diverticulitis
  - Immune compromised opportunistic
Pyogenic liver abscess

- Infecting mo
  - Enteric organisms; Streptococcus faecalis, Klebsiella, Proteus vulgaris, E coli, Streptococcus melleri
- Opportunistic staph
Clinical features:

- Nonspecific
- Fever, malaise, anorexia
- Right upper quadrant discomfort
- Jaundice occurs in up to one third of affected patients
Diagnosis:

- Lab investigations:
  - Leucocytosis,
  - an elevated erythrocyte sedimentation rate
  - an elevated alkaline phosphatase (AP) level
  - Blood cultures reveal the causative organism in approximately 50% of cases
Diagnosis:

- Ultrasound examination
  - reveals pyogenic abscesses as round or oval hypoechoic lesions with well-defined borders and a variable number of internal echoes
- CT scan
  - highly sensitive in the localization of pyogenic liver abscesses
Pyogenic liver abscess

Treatment:
- Antibiotics
- Percutaneous drainage under ultrasound guide

Look for the source
Amoebic Liver Abscess

- Causative:
  - Entamoeba histolytica
- Clinical Features
  - History of dysentery
  - Travel to endemic area
  - Symptoms
    - Non specific
Diagnosis:
- US
- CT scan

Confirmation is by isolation of the causative organism.

Treatment
- Metronidazol 750mg t.i.d for 5 – 10 days
Portal Hypertension

- Portal circulation:
  - Portal vein formed from confluence of SMV and splenic vein. Also a tributary from coronary (left gastric) vein.

- Portasystemic communications:
  - gastroesophagus junction
  - Anal canal
  - Retroperitoneum
  - Falciform ligament
Normal portal venous pressure is about 10 - 15 mmHg.
Aetiology:

- Liver cirrhosis
- Extrahepatic portal vein occlusion
- Intrahepatic veno-occlusive disease
- Occlusion of main hepatic veins (Budd-Chairi syndrome)
Clinical presentation:
- Variceal bleeding
- Decompensated chronic liver disease
  - Encephalopathy
- Ascitis
Diagnosis:

- High portal venous pressure (> 20mmHg)
  - Hepatic venography
  - Direct cannulation of portal vein
- Oesophagoscopy; oesophageal varices
- Doppler ultrasound and CT for patency of portal vein
Management of bleeding varices

- General resuscitation:
  - Blood replacement

- Coagulopathy:
  - Vit K iv
  - Fresh frozen plasma

- Thrombocytopenia  < 50*10^9/l

- Urgent endoscopy:
  - Confirm dx
  - therapy
Measures to stop bleeding:

- Drugs:
  - Vasopressin
  - Octreotide

- Endoscopic:
  - Sclerotherapy ethanolamine oleate
  - Banding
- Sengenstakin – Blackmore tube
  - Temporary control
Transjugular intrahepatic portosystemic stent shunt (TIPS)

Complication:
- perforation of liver capsule and fatal haemorrhage
- Occlusion
- Post shunt encephalopathy
Surgical shunts for variceal haemorrhage

- Child’s grade A cirrhosis in whom the initial bleed has been controlled by sclerotherapy

Types of shunts

- Selective; splenorenal
- Non-selective: porto-caval
Hydatid Liver Disease

- The causative tapeworm: Echinococcosis granulosis
- Liver is affected in 80% of cases, Lung 15%. And 5% rest organs.
Hydatid Liver Disease

► Clinical presentation:
  ► Incidental finding on Ultrasound examination
  ► Chronic right upper quadrant discomfort
  ► Complications of cyst:
    ► Rupture into peritoneum; features of
      ► acute peritoneal irritation
      ► Urticaria
      ► Anaphylaxis
Hydatid Liver Disease

- Rupture into biliary passages:
  - Jaundice and cholangitis
- Rupture into pleura:
  - Empyema
- Infection-----Liver abscess
Hydatid Liver Disease

- Diagnosis
  - Ultrasound exam
    - Multilocular cyst
  - CT scan
    - Floating membrane within the cyst
  - Serological
    - ELISA for Antibody against hydatid antigen
Hydatid Liver Disease

- Treatment:
  - Mainly surgical
    - Open
    - Laparoscopic
  - Other methods
    - Drugs Albendazol
    - Percutaneous injection of hypertonic saline or Alcohol
Hydatid Liver Disease

- Surgical options:
  - Deroofing and evacuation of contents
  - Liver resection
Liver tumors

- **Benign tumors:**
  - Haemangiomas
  - Adenoma
  - Focal nodular hyperplasia
Liver tumors

- **Malignant:**
  - Primary
    - Hepatocellular carcinoma
    - Cholangiocarcinoma
Liver tumors

- **Secondary metastasis**
  - Metastatic colorectal cancer
  - Metastatic neuroendocrine cancer (carcinoid)
  - Other metastatic cancers
Hepatocellular carcinoma

Aetiology:

- Association with chronic liver disease cirrhosis
  - HBV, HCV
Hepatocellular carcinoma

- Presentation
  - Middle aged
  - Features of chronic liver disease
  - Anorexia and Weight loss
Hepatocellular carcinoma

**Diagnosis:**
- Ultrasound
- CT scan
- Alpha fetoprotein
- For staging:
  - Chest scan
  - Bone scan
  - Laparoscopy
Hepatocellular carcinoma

Assessment of patient:

• General assessment
• Severity of underlying liver disease “Child score”
Hepatocellular carcinoma

Treatment:
• Surgical resection
• Liver transplantation

Depend on:
• Staging of liver tumor
• Size and site of tumor
• Availability of organ transplantation
Hepatocellular carcinoma

Palliative procedures

- Local Ablation techniques
  - Radiofrequency ablation
  - Ethanol ablation
  - Cryoablation
  - Microwave ablation
- Regional liver therapies
  - Chemoembolization/embolization
  - Hepatic artery pump chemoperfusion
Hepatocellular carcinoma

Follow up:

• Chemotherapy ??
• Alpha fetoprotein as tumor marker
• Imaging
Cholangiocarcinoma

- Elderly
- Primary sclerosing cholangitis
- Site: confluence of right and left hepatic ducts fibrous (Klatskin tumors)
Cholangiocarcinoma

- Presentation:
  - Elderly patient with progressive painless jaundice
Cholangiocarcinoma

- **Diagnosis:**
  - Ultrasound: dilated intrahepatic biliary passages but not extrahepatic bile ducts.
  - Spiral CT scan little evidence of mass
    - Regional lymphadenopathy
  - Cholangiography: hilar stricture
  - Brush cytology + ve in 2/3rds
Cholangiocarcinoma

Treatment:

• Surgical resection:
  • Radical resection of liver parenchyma and the affected bile ducts --- potentially curative
  • Local resection --- palliative
المحاضرة الثالثة
Impaired liver function:

- Depends on:
  - Severity of dysfunction
  - Rapidity; acute or chronic
Acute Liver Failure:

- is defined by the presence of hepatic encephalopathy occurring as the consequence of severe liver damage in a patient without a history of previous liver disease or portal hypertension.
Acute Liver Failure:

- Aetiology:
  - Viral Hepatitis, B, A, E, C,D
  - Drugs and toxins; halothane,
  - Overdose of Paracetamol
  - Mushroom poisoning
  - Acute Budd-Chiari syndrome
  - Wilson’s disease
  - Pregnancy –related
  - Indeterminate 20%
Acute Liver Failure:

- Clinical presentation:
  - Jaundice
  - Cerebral edema “Hepatic encephalopathy”;
    - drowsiness, liver flap, confusion and finally coma
Acute Liver Failure:

**Diagnosis:**

- **Acute Liver Failure Laboratory Evaluation**
  - Complete blood count
  - Complete metabolic panel
  - Arterial blood gas concentrations
  - ABO typing
  - Amylase and lipase levels
  - Acute hepatitis panel
  - Autoimmune marker levels
  - Ceruloplasmin level
  - Toxicology screening
  - Acetaminophen level
  - HIV screening
  - Pregnancy test (females)
- Liver function tests
- Bilirubin
- Prothrombin time/international normalized ratio
- Alkaline phosphatase
- AST, ALT
- Gamma-glutamyl transpeptidase
- Arterial serum ammonia level
Acute Liver Failure:

- **Treatment:**
  - **Supportive:**
    - IV fluids electrolyte balance
    - Acid – base balance
    - Nutrition
    - Renal support hemofiltration
    - Antibiotics
    - Ventilation in coma
    - Mannitol for cerebral edema
  - Liver transplantation
Chronic liver disease

- Clinical Features:
  - Lethargy and weakness
  - Jaundice

- Hyperdynemic circulation:
  - High COP
  - Large pulse volume
  - Low blood pressure
  - Flushed extremities
- Fever
- Skin changes:
  - Spider naevi
  - Palmer erythema
  - White nails (leuconychia)
Endocrine abnormalities:
- Hypogonadism
- Gynecomastia
- Hepatic encephalopathy
- Portal hypertension
- Flapping tremor of hands
- Abdominal distension; Ascitis
- Loss of muscle bulk and wasting
- **Child’s scoring**

- **Group**
  - **A**
  - **B**
  - **C**

- **Bilirubin mg/dl**
  - <2
  - 2–3
  - >3

- **Albumin g/dl**
  - >3.5
  - 3.0–3.5
  - <3.0

- **Encephalopathy**
  - None
  - minimal
  - advanced

- **Ascites controlled**
  - None
  - Easily Controlled
  - poorly

- **Nutrition**
  - Excellent
  - Good
  - Wasting

- **Child class**
  - Class A = 5–6 points
  - Class B = 7–9 points
  - Class C = 10–15 points
المحاضرة الثانية
Liver cirrhosis

Cirrhosis is the consequence of sustained wound healing in response to chronic liver injury.
Liver cirrhosis

- **Etiology of Cirrhosis**
  - Viral hepatitis (hepatitis B, C, and D)
  - Cryptogenic
  - Alcohol abuse
  - Metabolic abnormalities
    - Iron overload (hemochromatosis)
    - Copper overload (Wilson's disease)
    - Alpha-1-antitrypsin deficiency
    - Glycogen storage disease (types IA, III, and IV)
    - Tyrosinemia
    - Galactosemia
  - Cholestatic liver disease
  - Hepatic vein outflow abnormalities
    - Budd-Chiari syndrome
    - Cardiac failure
  - Autoimmune hepatitis
  - Toxins and drugs